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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/633,070	08/01/2003	Chin Cheng Yang	405400	4232

27717 7590 02/23/2005

SEYFARTH SHAW
55 EAST MONROE STREET
SUITE 4200
CHICAGO, IL 60603-5803

EXAMINER

SIEK, VUTHE

ART UNIT	PAPER NUMBER
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2825

DATE MAILED: 02/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H.A

Office Action Summary

Application No.

10/633,070

Applicant(s)

YANG, CHIN CHENG

Examiner

Vuthe Siek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 August 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-8 and 10 is/are rejected.
- 7) ☒ Claim(s) 5 and 9 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 8/1/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to application 10/633,070 filed on 8/1/2003.

Claims 1-10 remain pending in the application.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claim 7 is rejected under 35 U.S.C. 102(e) as being anticipated by Smith (US 2002/0192570).
4. As to claim 7, Smith teaches substantially similar mask for reducing proximity effect comprising a plurality of line-shaped features (resolvable features or main features items 21, 31, 41, 61, 91 described in Figs. 2, 3, 4, 6, 9); a plurality of groups of assist features (non-resolvable features or assist features items 22, 32, 42, 62, 92 described in Figs. 2, 3, 4, 6, 9), each group of assist feature positioned between two adjacent line-shaped features, where the assist feature is approximately rectangular in shape and the width of the assist feature larger than the length of the assist feature.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-4, 6, 8 and 10 are rejected under 35 U.S.C. 103(a) as being obvious over Smith (US 2002/0192570).

7. As to claim 1, Smith teaches substantially similar mask for reducing proximity effect comprising a plurality of line-shaped features (resolvable features or main features items 21, 31, 41, 61, 91 described in Figs. 2, 3, 4, 6, 9); a plurality of groups of assist features (non-resolvable features or assist features items 22, 32, 42, 62, 92 described in Figs. 2, 3, 4, 6, 9), each group of assist feature positioned between two adjacent line-shaped features, where the assist feature is approximately rectangular in shape and the width of the assist feature larger than the length of the assist feature. Smith teaches placing a plurality of assist features along side or between the main features or line-shaped features, where the assist features are in function of the line-shaped features space width in order to control the amount of space intensity reduction ([0017, 0018, 0019, 0062, 0063], Fig. 9, summary). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have placed each of a plurality of second assist features (assist feature 93 in Fig. 9 or scatter bars or assist features), between one of the plurality of plurality of line-shaped features or main features and one group of the first assist features because using a combination of first assist features (ladder bar assist features) and second assist features (scatter bars or simply assist features) would allow for improved design flexibility and improved control over the amount of space intensity reduction, and one of the significant

advantages of the ladder bars assist features is that they allow for the intensity reduction value to be easily and significantly varied in order to optimize imaging performance by simply varying the size of the ladder bars and the pitch of the ladder bars. In addition, Smith also suggests this is possible, in part, because due of the orientation of the ladder bars relative to the main features (line-shaped features), the pitch and size of the ladder bars are no longer constrained by the space between the main features. By properly selecting the width of the groups of ladder bar assist features, it is possible to control an effective frequency component of the ladder bars along the axis of the main edges and between the main feature edges, and to minimize the increase in the magnitude of the second diffraction order component, thereby reducing the likelihood that that the ladder bar assist features will print.

8. As to claim 2, Fig. 9 shows that the width of second assist feature 93 is equal or close to the length of the first assist feature 92.

9. As to claims 3-4, 8 and 10, Smith teaches the entire space between the main features experiences a reduction in intensity as a function of the bar width (second assist feature) and bar pitch. This result is expected if the space transmission is equivalently reduced. Diffraction energy of the main features is reduced, resulting in image with lower intensity which can allow for a mask exposure dose that more closely matches that of the other features on the mask [0017-0018]. Therefore, it would have been obvious to one ordinary skill in the art at the time the invention was made to have the space between the group of the first assist features and the second assist feature is equal to or larger than the width of the second assist feature, and space between the

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line-shaped features (main features) and the second assist feature (scatter assist bar), because by using a combination of the ladder bars (group of the first assist features) and the second assist feature (scatter bars or assist features) with these space conditions, it would avoid using multiple second assist features or scatter bars due the constraints the bar width and pitch values of the scatter bars and this would allow for improved design flexibility and improved control over the amount of space intensity reduction.

10. As to claim 6, Smith teaches the line-shaped feature corresponds to an isolation trench pattern to be formed on a wafer (main feature to be printed or formed on a wafer).

Allowable Subject Matter

11. Claims 5 and 9 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior does not teach or fairly suggest the length of the assist feature is smaller than two-fifths but larger than one-fourth of the wavelength of an exposure source.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vuthe Siek whose telephone number is (571) 272-1906. The examiner can normally be reached on Increase Flextime.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Vuthe Siek


VUTHE SIEK
PRIMARY EXAMINER